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Pressemitteilung

GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel
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Forschungsprojekte
Geowissenschaften, Meer / Klima
überregional

How do calderas form on island arc volcanoes and what impact do they have?

02.05.2025/Kiel. Which processes triggered the collapse of the caldera of the Brothers volcano off the coast of New Zealand several thousand years ago, and how are these linked to hot springs and deposits of raw materials? These are the questions being investigated by an international research team led by the GEOMAR Helmholtz Centre for Ocean Research Kiel. Aboard the research vessel SONNE, the scientists intend to produce the first high-resolution, three-dimensional image of the underwater volcano.

The SO312 BRASS expedition aims to measure the internal structure of the Brothers volcano off the coast of New Zealand in detail. For the first time ever, the expedition will also fully seismic map the collapse crater, or caldera, of a volcano. Using a special 3D seismic system and seafloor seismometers, the researchers will investigate whether the caldera formed as a result of one massive eruption or several smaller ones. This will enable important conclusions to be drawn regarding the natural hazards posed by island arc volcanoes. At the same time, they will investigate whether existing geological weak zones in the subsurface influenced its formation, and how the currently active hydrothermal systems are linked to these structures.

Volcanically active laboratory on the seafloor

“The Brothers volcano is like a laboratory on the seafloor for us. Nowhere else in the Kermadec Arc is there such an active caldera with so many hot springs and hydrothermal vents,” says Dr Christian Berndt, cruise leader and Professor of Marine Geophysics at the GEOMAR Helmholtz Centre for Ocean Research in Kiel. “This combination of a large volcanic crater, ultra-hot fluids, and unique habitats is key to understanding how underwater volcanoes work and how raw materials are formed on the seafloor.”

Following on from the MARUM drilling campaign

This expedition builds directly on a research cruise conducted by the MARUM Centre for Marine Environmental Sciences at the University of Bremen. During this cruise, research was also carried out on the Brothers volcano using the research vessel SONNE. That expedition focused on scientific drilling to study hydrothermal processes and the formation of seafloor metal deposits. This expedition complements those investigations by taking large-scale geophysical measurements, which provide important contextual data for interpreting the drill cores.

German–New Zealand partnership

The project is a successful example of international cooperation in marine research. In addition to GEOMAR, the New Zealand research organisation GNS Science (in Māori: Te Pū Ao) is also involved in the expedition. This collaboration on exploring the seabed around the Pacific island state has lasted for over thirty years, combining state-of-the-art technology with decades of local expertise. Recently, the Deputy New Zealand Ambassador to Germany, Evelyne Coulombe, also visited GEOMAR to find out more about the cooperation.

Knowledge for greater safety and sustainable resource utilisation

The results of the expedition will help us to better understand the history of the Brothers volcano and improve risk assessments for future eruptions and tsunamis in the region. At the same time, the results will provide a valuable foundation for assessing mineral deposits in the deep sea.

Background: Caldera

A caldera is a large, cauldron-shaped crater formed when large quantities of magma escape underground during a volcanic eruption. The overlying rock loses its supporting function and collapses. Such calderas can be several kilometres in size and hundreds of metres deep - both on land and underwater.

The expedition at a glance:

Name: BRASS (Brothers Volcano Seismic Structure)

Expedition leader: Professor Dr Christian Berndt

Period: 03.05.2025 – 29.05.2025

Start and end: Auckland (New Zealand)

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https://www.gns.cri.nz/our-science/land-and-marine-geoscience/te-riu-a-maui-our-continent/ GNS Land and Marine Geoscience

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